but 'the availability of an inexhaustible supply of new vocabularies in which to express, develop, constitute, and transform ourselves and our institutions . . .' (150), thus the goal of a political life is to enable this kind of positive freedom.

Brandom's philosophical heritage comes via Rorty and Sellars, with some nods to Wittgenstein and the American pragmatists. As a reviewer with a slightly different *heritage*, I might note that the notion of making it explicit is also a theme championed by Ryle under the banner of 'conceptual cartography'. The idea that the conceptual manifold should be explored by making explicit one's reasons or backings for claims was also developed by both John Wisdom and Stephen Toulmin though the latter two, both of whom attended Wittgenstein's lectures, make a great deal of the analogical reasoning that they think is prior to (in the sense of necessary for) grasping in the import of deductive inference. Brandom has worked carefully to resurrect a pragmatist programme in a largely hostile environment; a very interesting avenue for further investigation and elucidation of pragmatism, according to this reviewer, would involve looking in more detail at some of the heretofore unnoticed connections between the American and English branches of development.

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Signals: Evolution, Learning and Information

By BRIAN SKYRMS

OXFORD UNIVERSITY PRESS, 2010. VIII + 200 PP. £32.50

Suppose Max succeeds in communicating some information to Moritz by using signals. There seems to be no deep mystery behind their success as long as their preferences coincide (which they do, presumably). In this case, Max has nothing to hide from Moritz. All they need to have is a convention concerning the use of the signals. This basic setting, which was invented by David Lewis (1969), is the point of departure for Brian Skyrms's latest book, *Signals: Evolution, Learning, and Information*. Skyrms, however, goes much farther in investigating the structure and significance of signalling interactions.

Finding a signalling convention appears to be a moral certainty in the case of Max and Moritz. Even if Max and Moritz do not possess human rationality and are instead very simple organisms, like bacteria, one would expect the successful use of signals to evolve. Until fairly recently most people would have subscribed to the view that in Lewis signalling games the emergence of signalling is indeed a moral certainty. Skyrms himself did so in his (1996), where he studied the special case of only two signals in terms of a basic dynamic evolutionary model. Dynamic

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evolutionary models can describe the evolution of signalling from arbitrary initial conditions. In the special case of two signals, the answer from basic evolutionary dynamics is essentially affirmative. Signalling almost always evolves.

Given this result, its generalization to cases of more than two signals seems natural. After all, Max and Moritz's preferences are still aligned. For quite a while, I myself thought to have a proof for the general case. The proof turned out to be defective. Christina Pawlowitsch, an economist independently working on this problem at the same time, started out with the same intuitions. We both arrived at a different conclusion: the evolution of signalling is not a moral certainty, modulo some special cases. Ending up at a state where communication can fail is a real possibility.

Skyrms elaborates on these results in many different directions. For evolution, they are robust across many models. However, certain mechanisms, like mutation or assortment, often appear to have a positive effect on the evolution of signalling. Some level of communication seems to be a likely evolutionary outcome, after all.

A similar picture emerges from considering learning instead of evolution. As Skyrms points out, there even is a very simple algorithm that learns to signal with probability one. Even if this specific algorithm may not be a realistic description of many kinds of learning, together with the other results it shows that signalling is a very probable outcome of learning processes.

Most of the first eight chapters investigate this basic Lewisian signalling framework in the context of evolutionary and learning models. In addition, Skyrms provides numerous examples of signalling in nature and outlines how information theory can be used to capture the content of signals. This latter topic will be of considerable interest to epistemologists and philosophers of language. Received wisdom has it that information theory cannot capture semantic meaning in terms of, e.g., propositional content. Skyrms, however, sets out to develop a framework where propositional content is a special case of his notion of informational content.

For investigating these topics, Skyrms follows a particular methodological principle: try to fully understand a problem in its simplest non-trivial form before moving to more complex variations. This shows itself in the way each problem is translated into models of varying complexity. It is also exemplified in the general structure of the book, which leads from the basic Lewisian framework to more intricate models.

Chapter 6 considers deception. Max's and Moritz's preferences need not always be identical. Max may sometimes want to hide the true state of the world from Moritz. Such situations are important topics in evolutionary biology and economics. Partially conflicting interests arise in signalling between mates, between parents and offspring, between employers and employees, or between firms. There is also something for philosophers. Skyrms's analysis reveals when Kant's dictum that lying cannot be willed to be a universal law holds and when it fails to hold.

The remaining chapters of the book consider in a fairly brief manner a number of other topics. There may, for instance, be too few or too many signals in a Lewisian signalling game. The first case allows for an analysis of category formation, and the second establishes the emergence of synonyms.

Another aspect of signalling that is not touched upon in traditional signalling games is the possibility of introducing new signals. This has important consequences for learning signalling conventions. In particular, it may allow the players to get to states of perfect communication from other suboptimal states.

A last set of topics investigates signalling and information transfer in the context of networks. There may be more than one sender and receiver. This gives rise to signalling networks. Signalling networks are important for studying logic, information processing and teamwork. Moreover, signals can be combined in a compositional manner. Signalling networks with more than one sender can capture the composition of signals. And, finally, signalling networks may change over time as well which allows for the emergence of efficient information processing.

Dretske (1981) proposed a re-orientation of epistemology: epistemologists should focus on analysing information transfer. Skyrms's new book proceeds along these lines. He weaves together results from many different fields and lays out several avenues that should be pursued. It's concise and written very clearly. You can, in fact, read it over the course of a weekend. But, like Skyrms's two previous books on evolutionary game theory, you can think about the issues he is raising for many years.

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Laws and Lawmakers: Science, Metaphysics and the Laws of Nature

By MARC LANGE

OXFORD UNIVERSITY PRESS, 2009. XVIII + 258 PP. £54.00 CLOTH, £15.99 PAPER

Marc Lange's new book on laws offers a restatement and development of the account he proposed in *Natural Laws and Scientific Practice* (Oxford University Press, 2000), henceforth NLSP, and the new material is helpfully summarized in the preface. *Laws and Lawmakers* presents the key idea from NLSP in a rather more reader-friendly manner – this idea being roughly that the difference between laws and accidents is that laws, unlike accidents, form a 'stable' set, i.e. a logically closed set of truths such that they would all still hold under any counterfactual supposition consistent with the set. So, for example, the natural laws all still hold under counterfactual suppositions such as 'had this match been struck . . .', 'had Bill Gates wanted to build a gold cube one mile across' and so on; thus this set is stable. But the set of laws plus the accidental claim 'there is no gold cube one mile across' fails to hold under such counterfactual suppositions because had Bill Gates wanted to build a gold cube one mile across, such

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